TRB
TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

NCHRP 14-31 Framework for Pavement Maintenance Database System

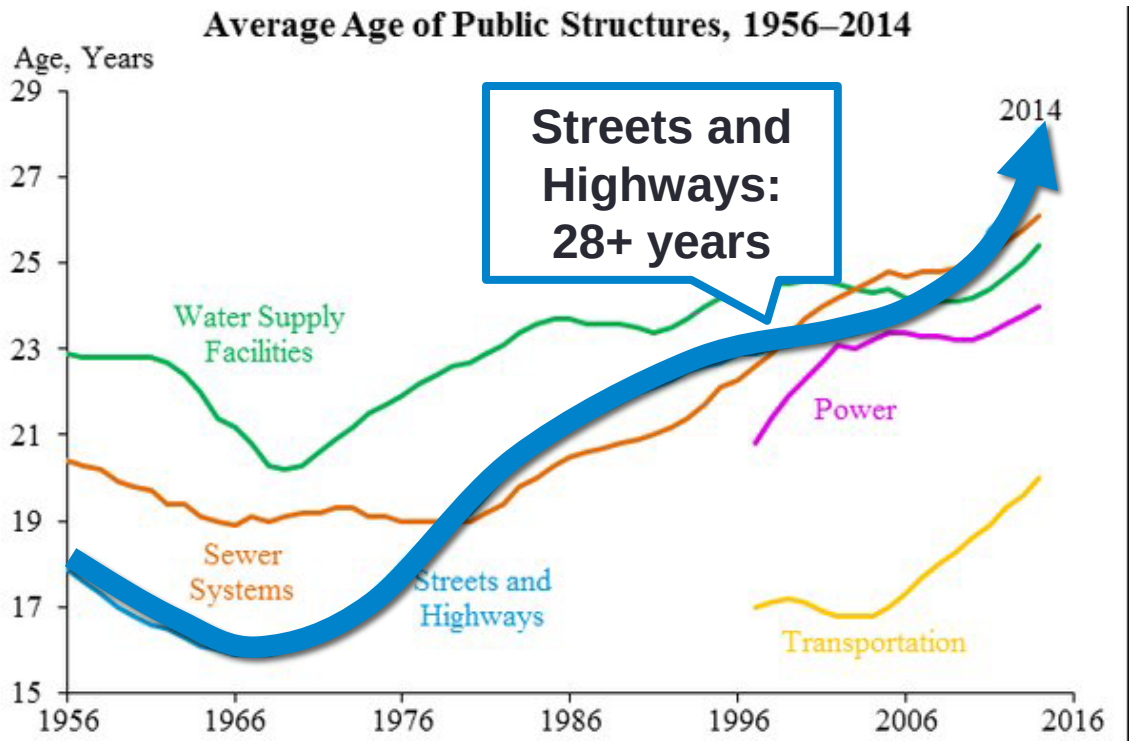
Today's Presenters

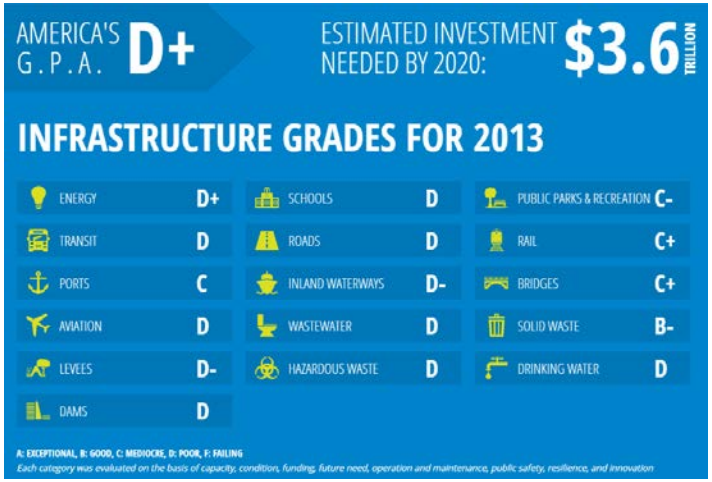
- **NCHRP 14-31 Framework for Pavement Maintenance Database System**
  - **Pavia Systems**
    George White, CEO/Co-Founder
    Steven Velozo, CTO

A Transportation infrastructure is fundamental to our way of life.

Why we do what we do…

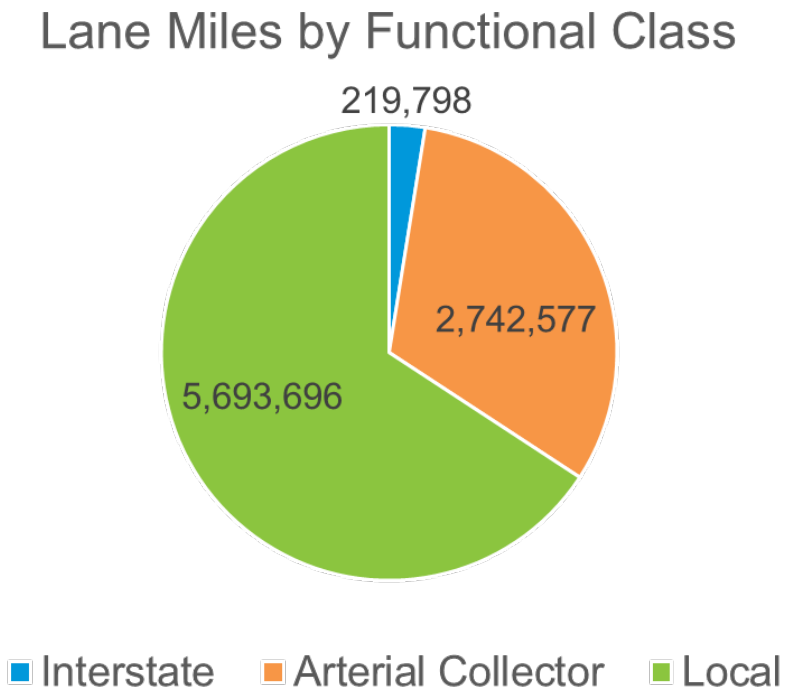
Our infrastructure is aging…

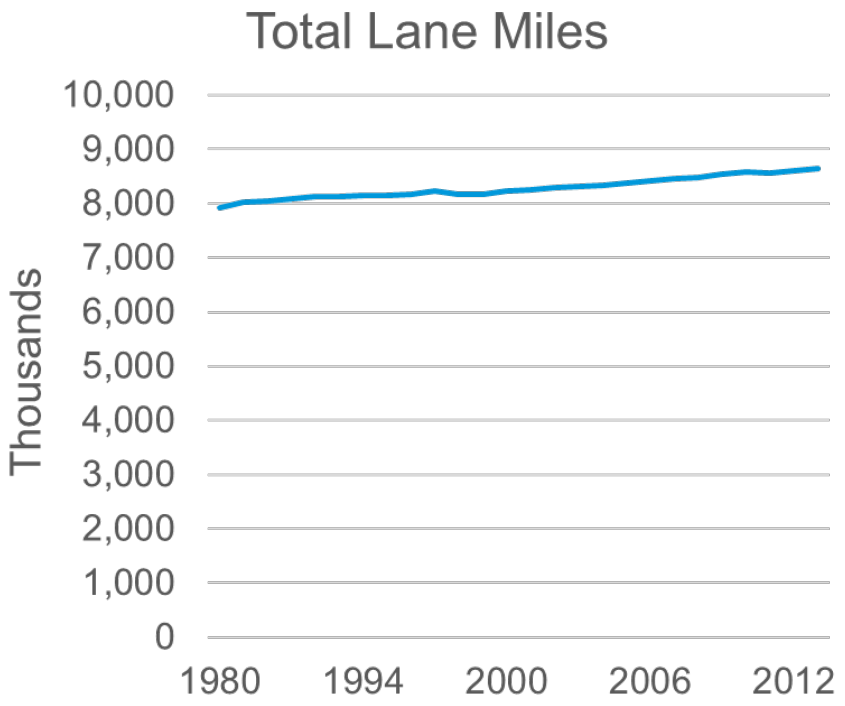




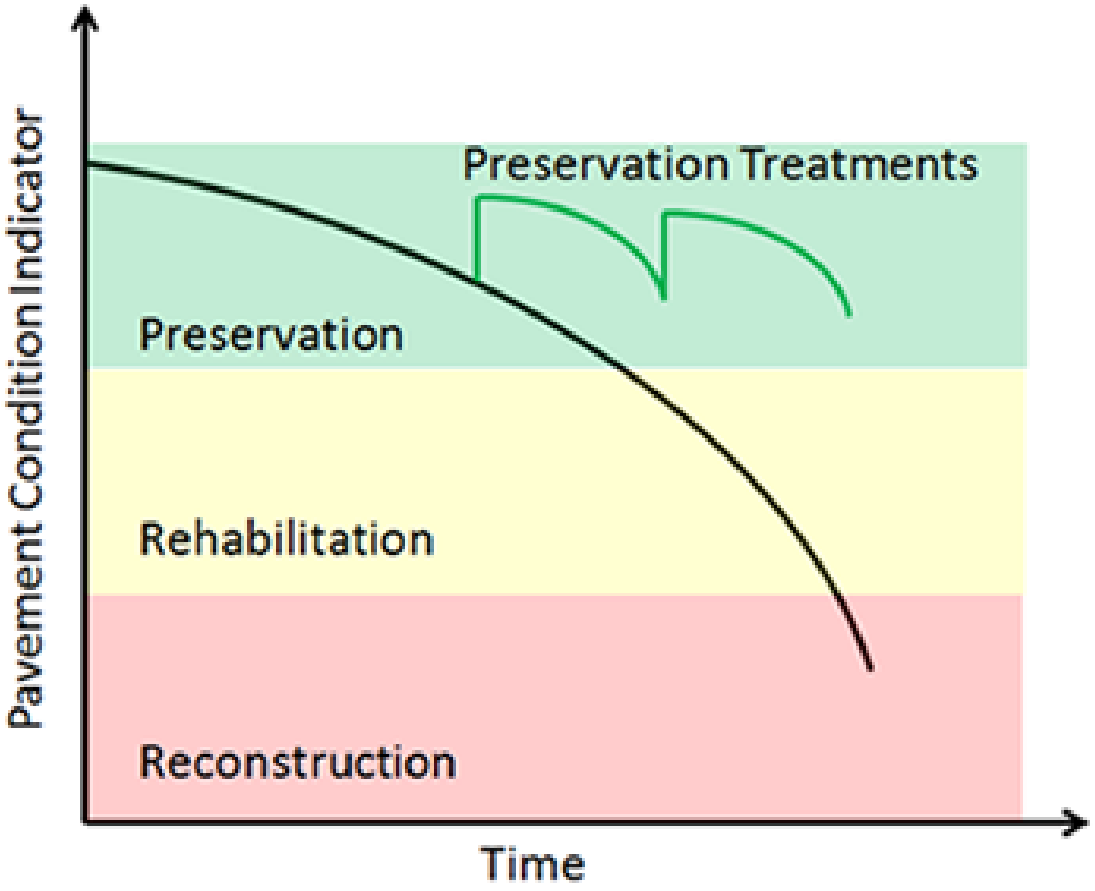
Sources: Bureau of Economic Analysis, ASCE

And we're not "adding" lane miles…





We're working to preserve and maintain…

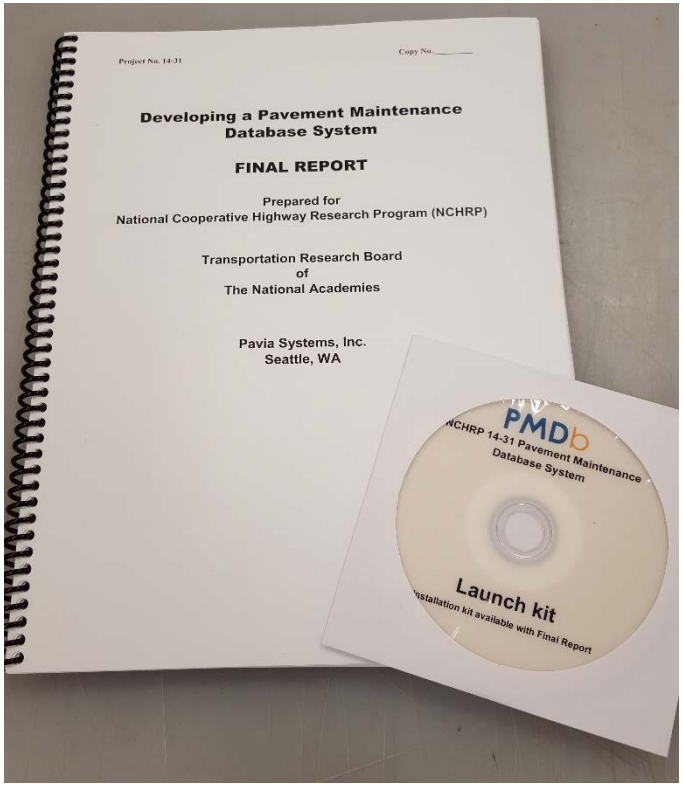


Was this the right treatment at the right time to extend my pavement life effectively?

Are there maintenance or preservation activities I should put in to my “toolbox”?

NCHRP 14-31: Objectives

- Develop a database system of pavement-maintenance actions, materials, and methods, and their effectiveness.
- Include uniform descriptions of maintenance activities, basis of measurement, costs, pavement condition, and other relevant data



Team and Panel

paviasystems

applied pavement TECHNOLOGY

The “cliff notes” of the approach

1. Define Data Elements and Terms

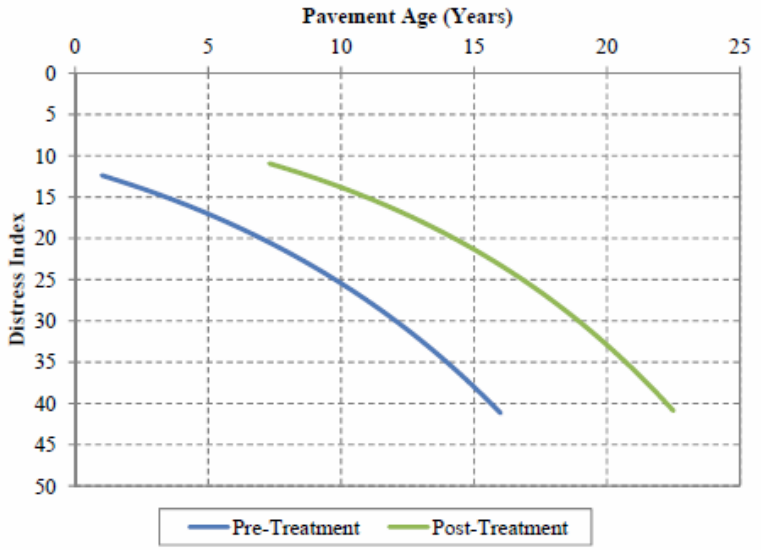
- Information Review
- Establish Data Categories and Elements
- Panel Review and Feedback

2. Develop Database Framework

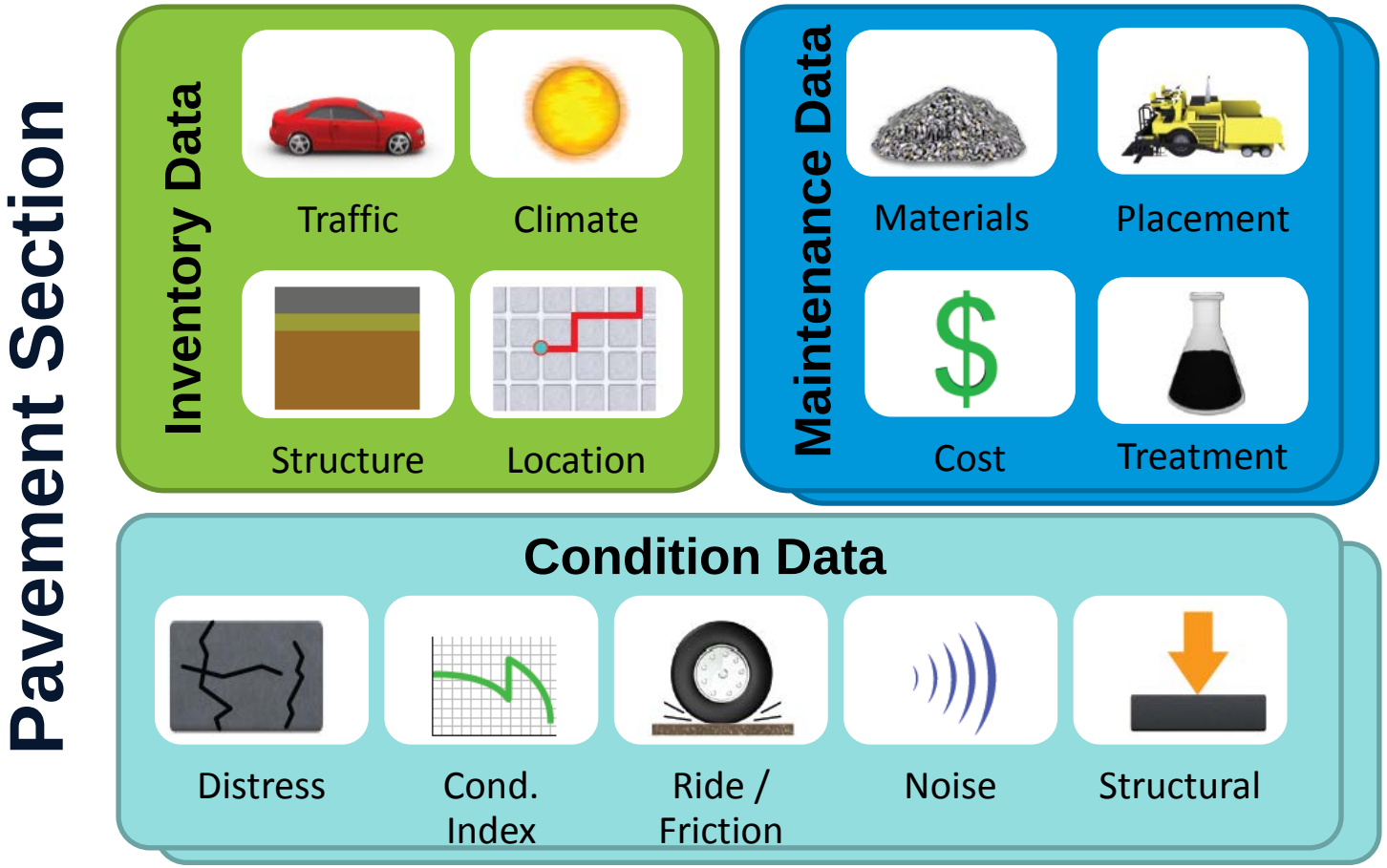
- Develop draft version of database system
- Address feedback on system
- Obtain and enter data from transportation agencies (limited)
- Refine database system

Examples of desired analysis to answer big questions

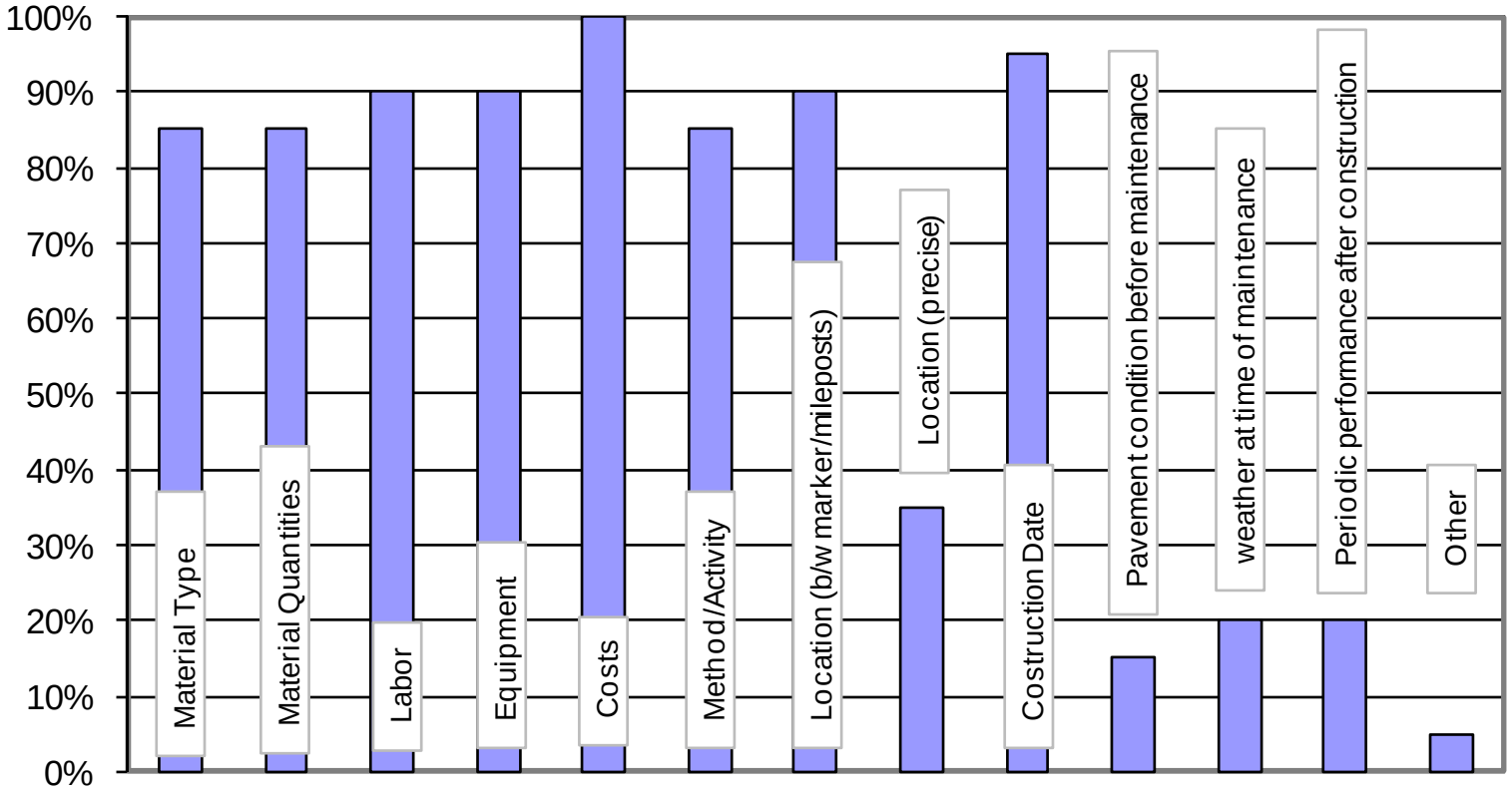
- Develop pre- and post-treatment performance trends using time series data from database
- Analyze performance benefits when compared to pre-treatment performance
- Compare benefits and unit costs to arrive at benefit-cost ratios for various treatments using different performance indicators



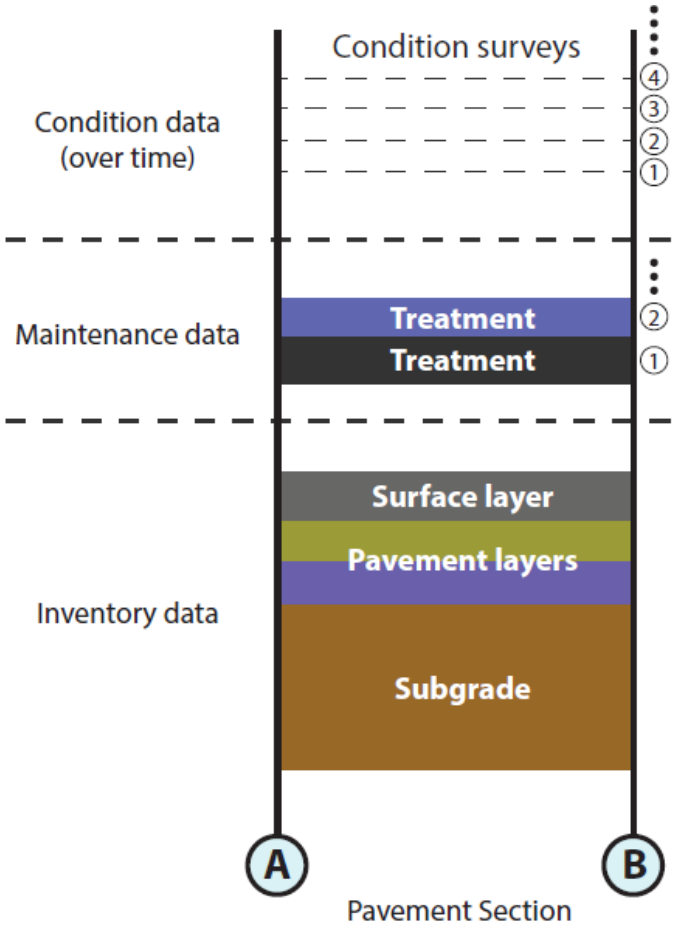
What are the data elements needed?



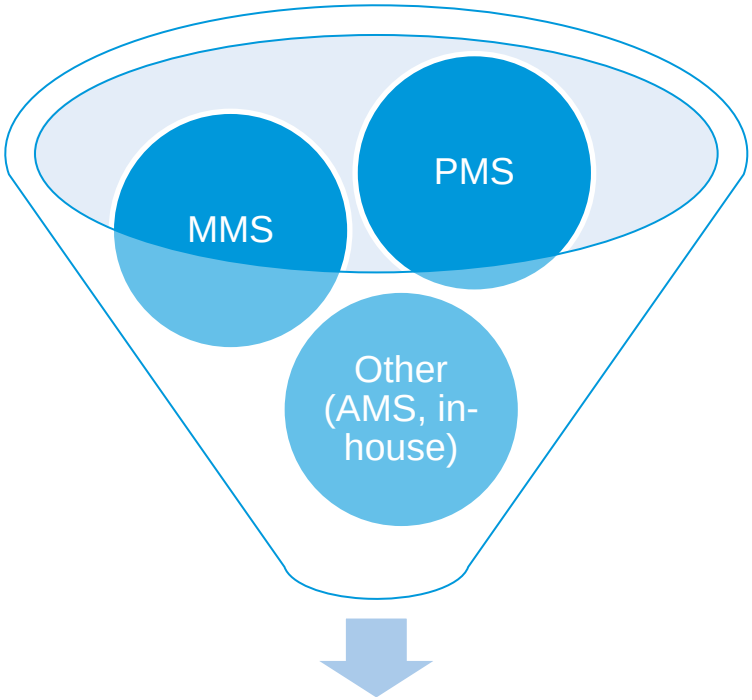
What data should be captured, when, by who?



Anatomy of a pavement section



Where does that data currently reside?



Pavement Maintenance Database

Definition of terms and data elements

Provide common definition of the elements, terms, and values to create a **common lexicon around which to persist data.**

Treatments Definitions for Asphalt-Surfaced Pavements	Treatment Definitions for Concrete-Surfaced Pavements
Crack Filling/Sealing	Joint/Crack Sealing
Asphalt Patching	Slab Stabilization/Slab Jacking
Fog Seals/Rejuvenators	Diamond Grinding/Grooving
Chip Seals	Partial-Depth Repairs
Slurry Seals	Full-Depth Repairs
…	…

Inventory Data Elements

Data Element	Attributes/Description
Pavement Section ID	• Unique identifier for a section of a pavement with a homogeneous cross section.
Pavement Section Location	• Route, Direction, Lane, Begin Reference Point, End Reference Point (milepost, accumulated route mile) • GPS coordinates of start and end points of section (when available) • Station/Offset (when available)
Functional Classification	• Route type (Interstate, Principal Arterials, Minor Arterials, Collectors, Local Roads, etc.)
Climatic Zone	• Dry Freeze, Wet Freeze, Dry No Freeze, Wet No Freeze
Traffic	• Year • Traffic Count (AADT, ADT) • % commercial/truck traffic

Inventory Data Elements

Data Element	Attributes/Description
Pavement Surface	• Material (asphalt, concrete, existing preservation treatment) • Thickness
Pavement Layers (one for each layer)	• Layer number • Material (aggregate type/gradation, binder, additives, other proprietary products etc.) • Thickness • Function (base, structural, wearing, repair)
Pavement Subgrade	• Subgrade material and other relevant information
Major Rehabilitation History	• Month/year construction started • Month/year open to traffic • Type of work performed

Maintenance Data Elements

Data Element	Attributes/Description
Maintenance Section Unique ID	• Unique identifier for the pavement section on which the maintenance treatment is placed
Maintenance Treatment	• Treatment name • Treatment type (routine, reactive, preventive) • Reason for treatment placement (to identify the if the treatment was placed to address safety, noise, or other conditions)
Maintenance Section Location	• Pavement section location data attribute type (to be linked using the Unique IDs)
Materials Data (when applicable)	• Aggregate type/gradation • Binder • Additive • Proprietary product and manufacturer

Maintenance Data Elements

Data Element	Attributes/Description
Treatment Placement Details	• Treatment number • Thickness • Placement procedure/standard/specifications • Equipment used • Facility downtime • Construction start date • Open to traffic date
Treatment Service Details	• Pre-treatment condition (link to Pavement Condition data element) • Treatment service termination month/date (link to month/date of maintenance treatment placement or month/date of major rehabilitation), • Reason for treatment service termination (condition deterioration, safety concerns, other pavement improvement projects, etc.)

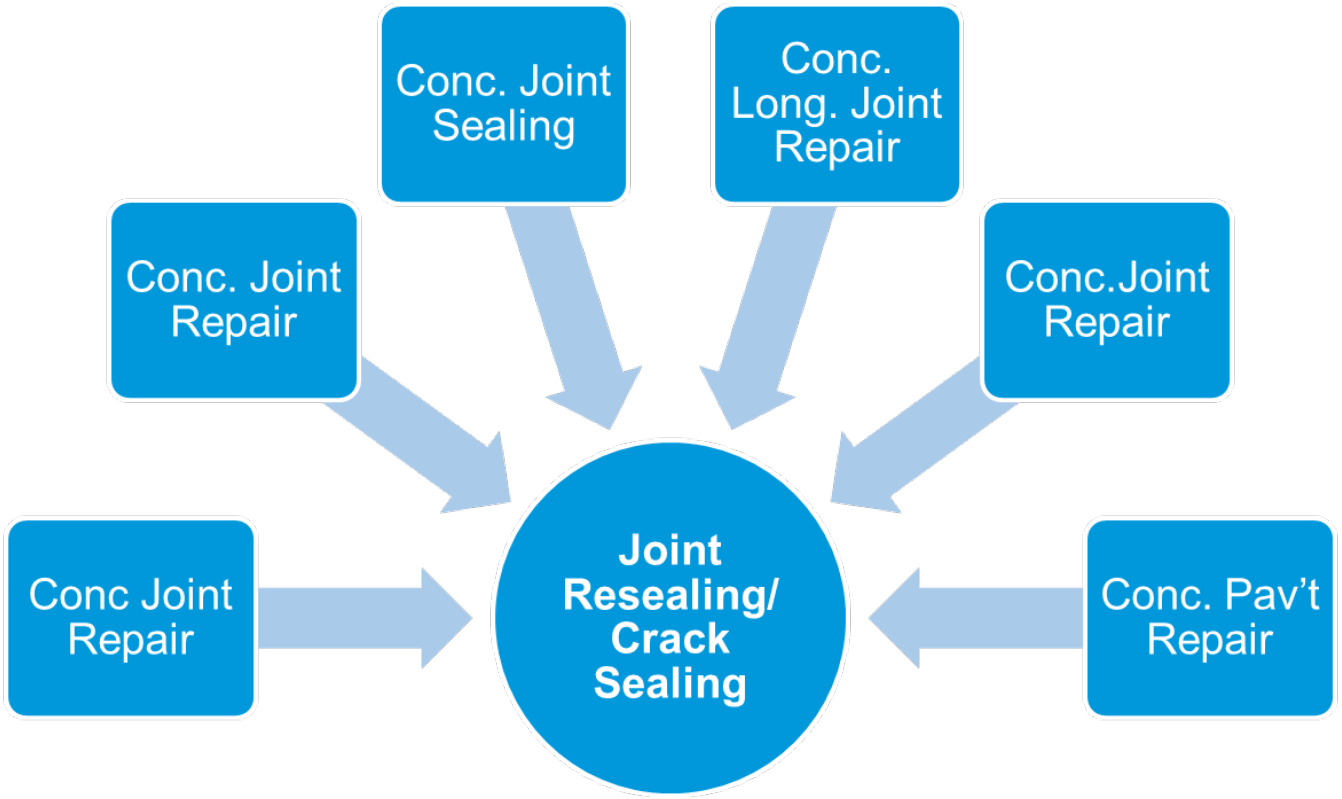
Maintenance Data Elements

Data Element	Attributes/Description
Treatment Cost	• Labor • Equipment • Materials • Pay items • Traffic mobilization • Overhead • Other
Contracting Mechanism	• Contract type (In-house, performed by contractor, warranty, etc.)

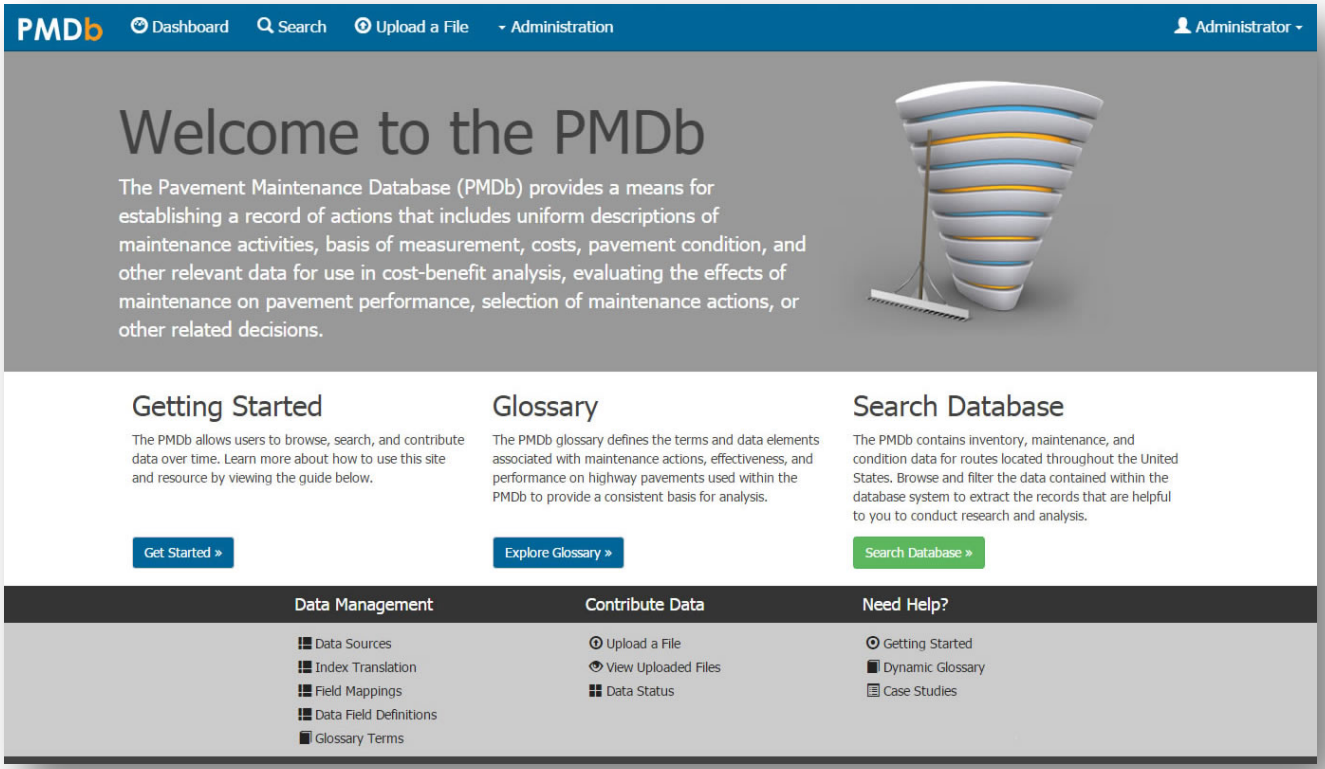
Pavement Condition Data Elements

Data Element	Attributes/Description
Raw Distress Data	• Distress type • Severity • Quantity
Overall Condition Indices	• PCI, PCR, other composite indices used
Friction Data	• Friction indices name (Friction Number, other friction indices used) • Friction value
Ride Quality	• Ride indices name (IRI, PI, PSI, RQI, other indices used) • Ride indices value
Noise Data	• Pavement-tire noise data
Structural Condition Data	• Data from non-destructive testing (e.g. elastic modulus data computed using FWD data)
Data Collection Method	• Manual/automated • Type of equipment used

The importance of common definitions and consistent data collection.

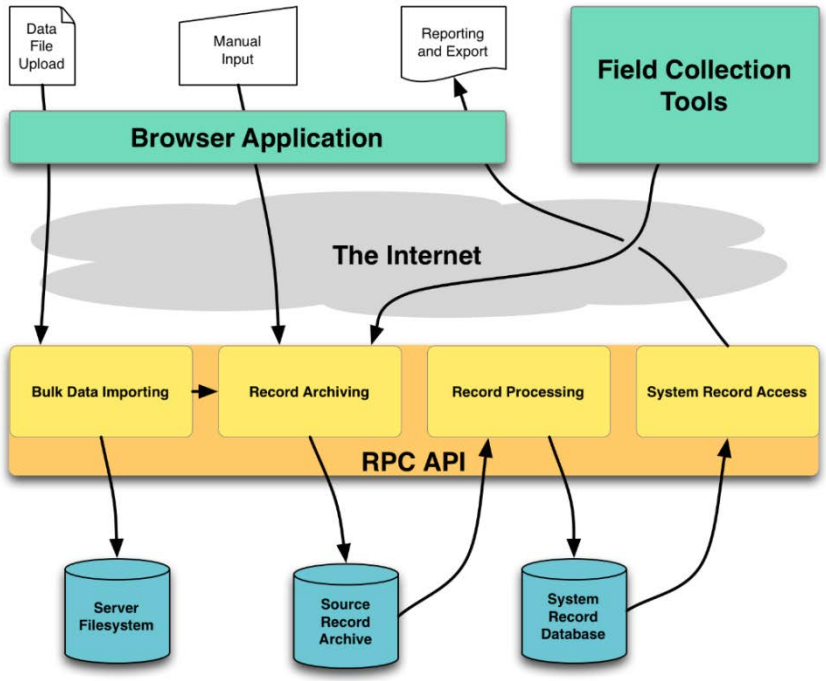


Developing a database framework

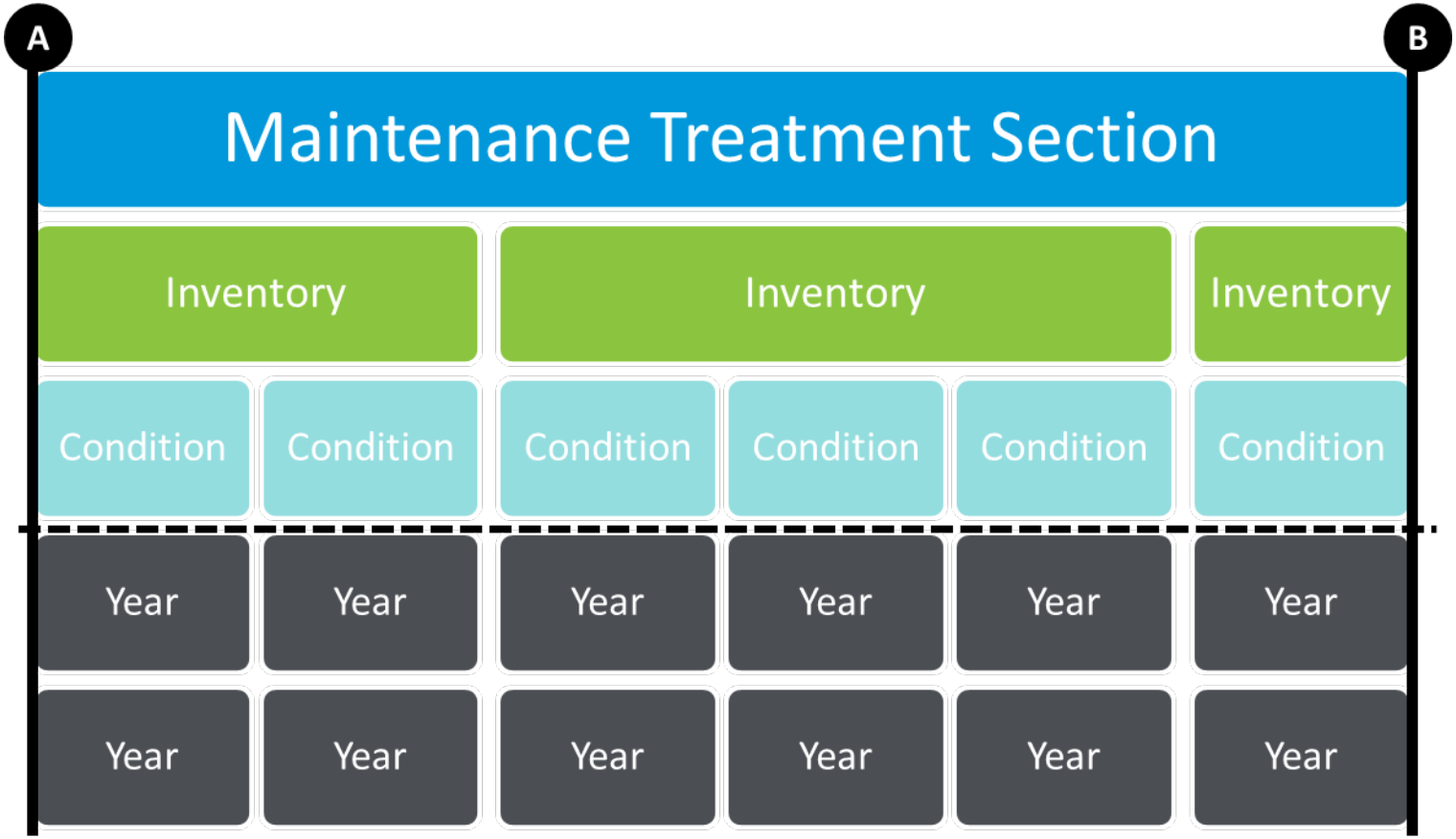


What Is The PMDb?

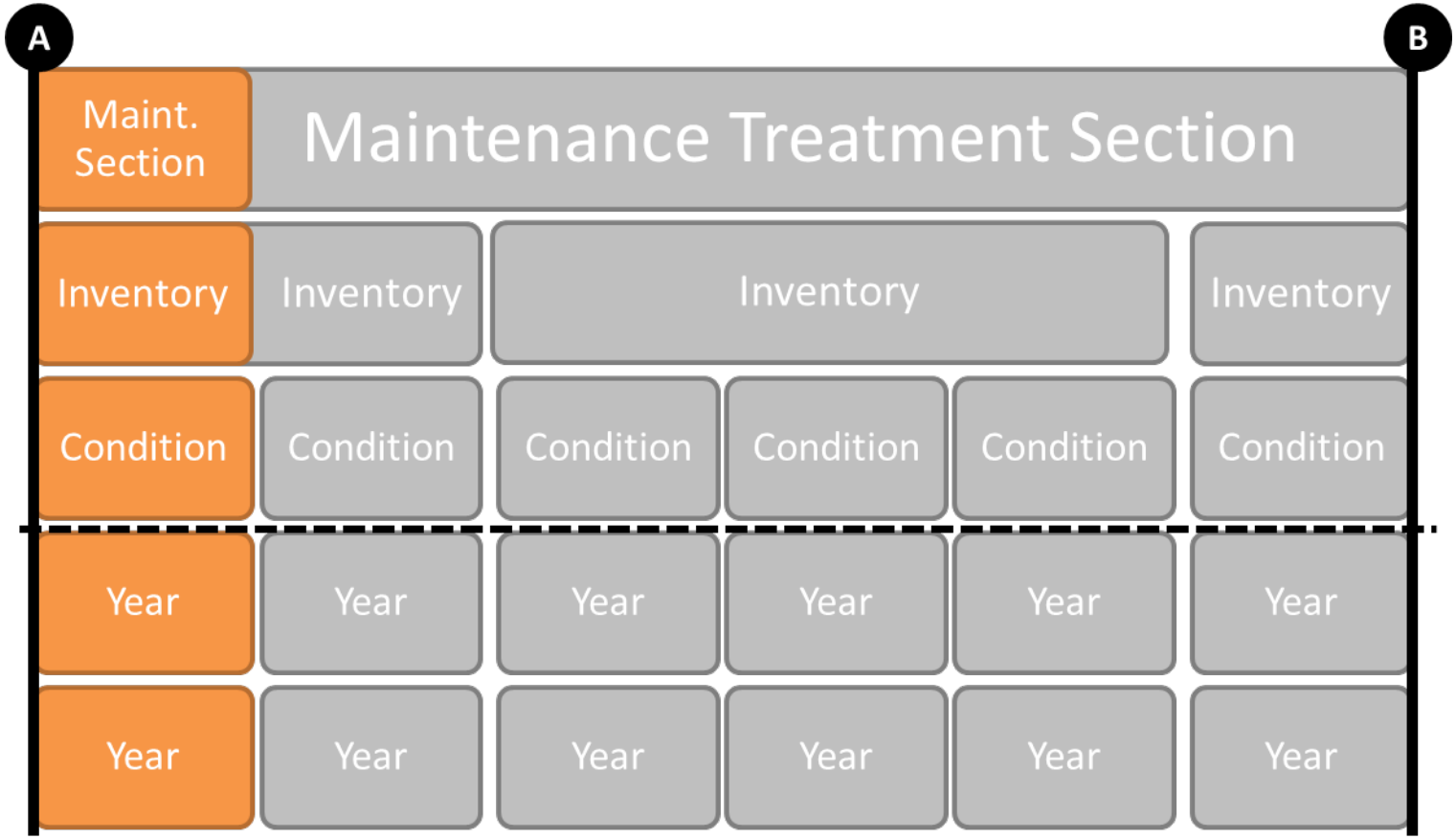
- Database and accompanying browser application
- Event-based data model for segments unique based on location and time
- Maps back to source data
- Allows us to cluster data to perform data aggregations



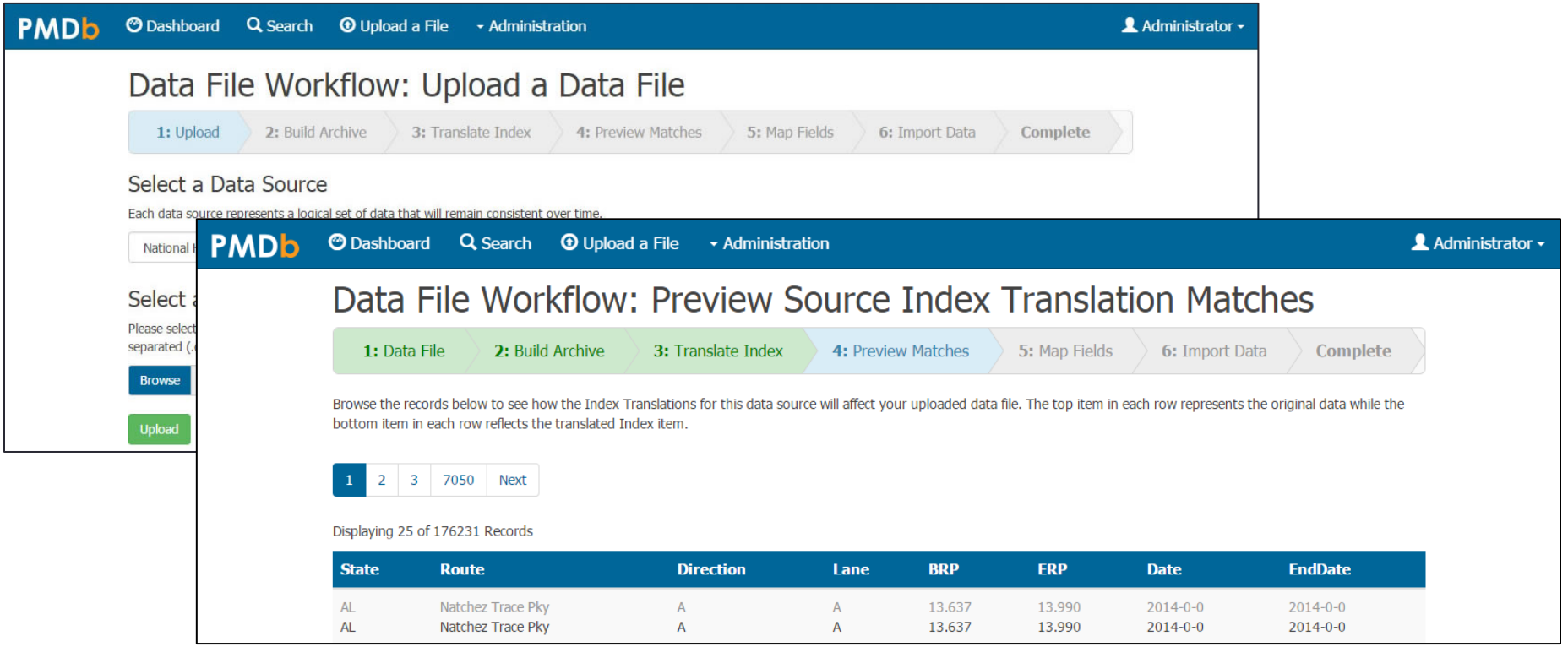
PMDb: Source Record Segment



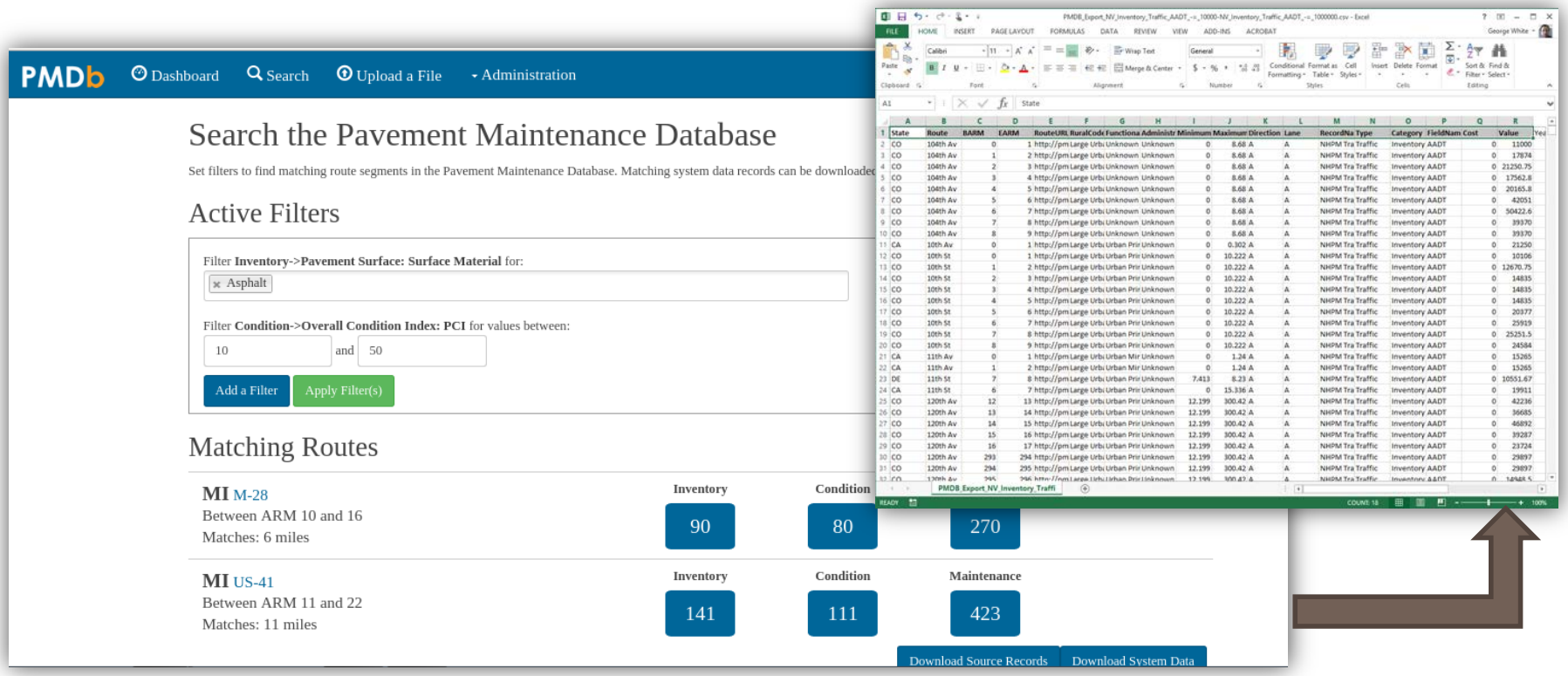
PMDb: System Record Segment



Workflows for combining and cleansing data



Workflows for query and extraction



Existing Data Gaps Identified

- Reason for treatment application (whether placed to address noise, friction, seal surface etc.)
- Cost of treatment on a project-by-project basis
- Equipment used to perform maintenance activity
- Materials data and quantities used
- Condition of underlying pavement prior to treatment placement
- Accurate location of maintenance treatment and link between maintenance data and PMS data
- Inconsistency in treatment identification
- Absence of treatment history

Key Takeaways

- There are a wide range of data collection practices and policies and gaps to resolve.
- The questions we seek to answer demand consistency in that data over time and a persistent framework
- This database framework provides a basis for that effort

And as research goes…what's next?

Implementation– identify remaining gaps and efforts needed:

- Data collection best practices "**what**" – resolve gaps!
- Guidance for "**how**" to obtain data
- Guidance for working with other data providers "**who**"
- Common key performance measures "**why**"

Thank you.